

WHAT IS CLAIMED IS:

1. A method of attaching unmodified biopolymers to a solid support comprising the steps of:

5 (a) providing unmodified biopolymers;

(b) providing a solid support having at least one surface comprising pendant acyl fluoride functionalities; and

(c) contacting the unmodified biopolymers with the solid support under a condition sufficient for allowing the attachment of the biopolymers to the solid support.

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2. The method of claim 1, wherein biopolymers are selected from a group consisting of nucleic acids, polypeptides, proteins, carbohydrates, lipids and analogues thereof.

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3. The method of claim 2, wherein the biopolymers are selected from a group consisting of polynucleotides, protein A, antibodies or streptavidin.

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4. The method of claim 3, wherein the biopolymer is a polynucleotide.

5. The method of claim 4, wherein the polynucleotide is selected from a group consisting of synthesized oligonucleotide, amplified DNA, cDNA, single stranded DNA, double stranded DNA, PNA, RNA or mRNA.

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6. The method of claim 4, wherein the length of the polynucleotide is in the range of about 3 bp to 10 kb.

7. The method of claim 6, wherein the length of the polynucleotide is in the range of about 100 bp to 1.5 kb.

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8. The method of claim 5, wherein the length of the oligonucleotide is in the range of about 3 to 100 oligonucleotide.

9. The method of claim 8, wherein the length of the oligonucleotide is in the range of about 15 to 20 oligonucleotide.

10. The method of claim 1, wherein the solid support is selected from a group consisting of polymeric materials, glasses, ceramics, natural fibers, silicons, metals and composites thereof.

11. The method of claim 1, wherein the solid support is a polymeric material selected from a group consisting of ethylene acrylic acid, ethylene methacrylic acid, carboxylated PVDF, carboxylated polypropylene or carboxylated polyethylene, and copolymers thereof.

12. The method of claim 1, wherein the step (b) further comprising a step of coating of an inert solid support with a polymeric material containing pendant acyl fluoride functionalities or capable of supporting pendant acyl fluoride functionalities.

13. The method of claim 1, wherein the solid support is made of a porous or non-porous material.

20 14. The method of claim 14, wherein the solid support is in a form of threads, sheets, films, gels, membranes, beads, plates and like structures.

15. The method of claim 1, wherein the solid support is fabricated from plastic in the form of a planar device having discrete isolated areas in the form of wells, troughs, 25 pedestals, hydrophobic or hydrophilic patches, diecut adhesive reservoirs or other physical barriers to fluid flow.

16. The method of claim 15, wherein the solid support is a microplate.

30 17. The method of claim 15, wherein the plastic is a polypropylene surface treated with acyl fluoride functionalities.

18. The method of claim 1, wherein the contacting step is carried out by a technique selected from a group consisting of jet printing, solid or open capillary device contact printing, microfluidic channel printing, silk screening, and a technique using printing devices based upon electrochemical or electromagnetic forces.

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19. The method of claim 18, wherein the contacting step is carried out by spotting the unmodified biopolymers to the solid support.

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20. The method of claim 1, wherein the condition is a basic pH condition.

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21. The method of claim 20, wherein the basic pH condition is maintained in a printing medium at pH of about 8 to 12.

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22. The method of claim 21, wherein the printing medium contains a salt.

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23. The method of claim 22, wherein the salt is LiCl.

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24. The method of claim 21, wherein the printing medium comprises a sodium bicarbonate-carbonate buffer.

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25. The method of claim 20, wherein the basic pH condition has a pH of 9-12.

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26. The method of claim 1, wherein the biopolymers are polynucleotides, and the polynucleotides are spotted on the solid support under a pH condition of 9-10.

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27. The method of claim 1, wherein the biopolymers are polynucleotides, and the polynucleotides are jet printed on the solid support under a pH condition of 10-12.

✓ 28. A method of analyzing a biopolymer target in a sample comprising the steps of:  
(a) providing a solid support fabricated of a material having pendent acyl fluoride groups on at least one surface;

(b) providing an agent that can form a complex with the biopolymer target, wherein the agent comprises a second biopolymer;

(c) contacting the solid support with either the agent or the biopolymer target under a condition that allows the attachment of either the unmodified agent or the unmodified biopolymer to the solid support, wherein the agent and the biopolymer target are unmodified;

5 (d) contacting the solid support attached with the unmodified agent with the biopolymer target, or contacting the solid support with the attached, unmodified biopolymer target with the agent under a condition that allows the formation of a complex comprising the agent and the biopolymer target;

10 (e) detecting and determining the presence of the complex as a measurement for the presence or the amount of the biopolymer target contained in the sample.

29. The method of claim 28, wherein in step (c) the agent is attached to the surface of the solid support, and in step (d) the solid support with the attached, unmodified agent is contacted with the biopolymer target under a condition that allows the formation of a complex comprising the agent and the biopolymer target.

30. The method of claim 28, wherein in step (c) the biopolymer target is attached to the surface of the solid support, and in step (d) the solid support with the attached, unmodified biopolymer target is contacted with the agent under a condition that allows the formation of a complex comprising the agent and the biopolymer target.

31. The method of claim 28, wherein the biopolymer target is selected from a group consisting of nucleic acids, polypeptides, proteins, carbohydrates, lipids and analogues thereof.

32. The method of claim 28, wherein the biopolymer target is selected from a group consisting of polynucleotides, protein A, antibodies or streptavidin.

30 33. The method of claim 28, wherein the agent comprises a biopolymer selected from a group consisting of nucleic acids, polypeptides, proteins, carbohydrates, lipid, and analogues thereof.

34. The method of claim 28, wherein the agent comprises a biopolymer selected from a group consisting of polynucleotides, protein A, antibodies or streptavidin.

5 35. The method of claim 28, wherein the biopolymer target is a polynucleotide, and the agent comprises a polynucleotide probe that is complimentary to the polynucleotide.

10 36. The method of claim 35, wherein the complex comprises the polynucleotide and the polynucleotide probe, and the complex is formed by hybridization of the polynucleotide probe to the polynucleotide.

15 37. The method of claim 28, wherein the biopolymer is a protein, and the agent comprises an antibody that recognizes the protein.

20 38. The method of claim 37, wherein the complex comprises the protein and the antibody to the protein, and the complex is formed by binding of the antibody to the protein.

25 39. The method of claim 28, wherein the biopolymer is a ligand, and the agent comprises a receptor that can bind to the ligand.

40. The method of claim 28, wherein the biopolymer is a receptor, and the agent comprises a ligand that can bind to the receptor.

41. The method of claim 39 or 40, wherein the complex comprises the ligand and the protein, and the complex is formed by the binding of the ligand to the receptor.

42. The method of claim 28, wherein in step (c) the agent or the biopolymer target is covalently attached to the surface of the solid support.

43. The method of claim 28, wherein the complex further comprises a reporter molecule selected from the group consisting of dyes, chemiluminescent compounds, enzymes,

fluorescent compounds, metal complexes, magnetic particles, biotin, haptens, radio frequency transmitters and radioluminescent compounds.

44. The method of claim 28, wherein the solid support is selected from a group consisting of polymeric materials, glasses, ceramics, natural fibers, silicons, metals and composites thereof.

45. The method of claim 28, wherein the solid support is a polymeric material selected from a group consisting of ethylene acrylic acid, ethylene methacrylic acid, carboxylated PVDF, carboxylated polypropylene or carboxylated polyethylene, and copolymers thereof.

46. The method of claim 28, wherein the step (a) further comprising a step of coating of an inert solid support with a polymeric material containing pendant acyl fluoride functionalities or capable of supporting pendant acyl fluoride functionalities.

47. The method of claim 28, wherein the solid support is in a form of threads, sheets, films, gels, membranes, beads, plates and like structures.

48. The method of claim 28, wherein the solid support is fabricated from plastic in the form of a planar device having discrete isolated areas in the form of wells, troughs, pedestals, hydrophobic or hydrophilic patches, diecut adhesive reservoirs or other physical barriers to fluid flow.

49. The method of claim 48, wherein the solid support is a microplate.

50. The method of claim 48, wherein the plastic is a polypropylene surface treated with acyl fluoride functionalities.

51. The method of claim 28, wherein the agent or the biopolymer target is printed onto the surface of a plastic disk containing pendant acyl fluoride functionalities, and the disk

is inserted into the bottom of the microplate well to form the solid support attached with the unmodified agent or unmodified biopolymer target.

52. The method of claim 48, wherein the same or different unmodified agents or biopolymer targets are attached to different discrete isolated areas in the planar device to form an array.

53. The method of claim 48, wherein at least 1 to about 1536 unmodified agents or biopolymers are attached to at least 1 to about 1536 discrete isolated areas in the planar 10 device.

54. The method of claim 53, wherein the planar device is a microplate, and the discrete isolated areas are wells of the microplate.

✓15 55. A device comprising a plurality of unmodified biopolymer and a solid support, wherein the solid support has at least one surface comprising pendant acyl fluoride functionalities, and wherein the biopolymer is attached to the solid support by reaction with the pendant acyl fluoride functionalities.

20 56. The device of claim 55, wherein the biopolymer is selected from a group consisting of nucleic acids, polypeptides, proteins, carbohydrates, lipids and analogues thereof.

57. The device of claim 55, wherein the biopolymers are selected from a group consisting of polynucleotides, protein A, antibodies or streptavidin.

25 58. The device of claim 55, wherein the biopolymer is a polynucleotide.

59. The device of claim 58, wherein the polynucleotide is selected from a group consisting of synthesized oligonucleotide, amplified DNA, cDNA, single stranded DNA, 30 double stranded DNA, PNA, RNA or mRNA.

60. The device of claim 55, wherein the biopolymers may be the same or different.

61. The device of claim 55, wherein the solid support is selected from a group consisting of polymeric materials, glasses, ceramics, natural fibers, silicons, metals and composites thereof.

62. The device of claim 55, wherein the solid support is a polymeric material selected from a group consisting of ethylene acrylic acid, ethylene methacrylic acid, carboxylated PVDF, carboxylated polypropylene or carboxylated polyethylene, and copolymers thereof.

63. The device of claim 55, wherein the solid support is in a form of threads, sheets, films, gels, membranes, beads, plates and like structures.

64. The device of claim 55, wherein the solid support is fabricated from plastic in the form of a planar device having discrete isolated areas in the form of wells, troughs, pedestals, hydrophobic or hydrophilic patches, diecut adhesive reservoirs or other physical barriers to fluid flow.

65. The device of claim 64, wherein the solid support is a microplate.

66. The device of claim 64, wherein the plastic is a surface treated with acyl fluoride functionalities.

67. The device of claim 66, wherein the plastic is selected from a group consisting of polypropylene, polystyrene, polysulfone, polyethylene and copolymers thereof.

68. The device of claim 64, wherein the biopolymers are attached to different discrete, isolated areas to form an array, and wherein the biopolymers may be the same or different.

69. The device of claim 55, wherein the device is prepared by a method comprises the steps of:

(a) providing a plurality of unmodified biopolymers;

5 (b) providing a solid support having at least one surface comprising pendant acyl fluoride functionalities; and

(b) contacting the plurality of unmodified biopolymers with the solid support under a condition sufficient for allowing the attachment of each biopolymer to the solid support at a discrete location on the solid support.

10 70. The device of claim 69, wherein the solid support has a plurality of discrete, isolated locations, and the biopolymers are attached to the solid support at the respective discrete, isolated locations.

71. The device of claim 70, wherein the biopolymers are the same or different.

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